



US005772451A

## United States Patent [19]

Dozier, II et al.

[11] Patent Number: 5,772,451

[45] Date of Patent: Jun. 30, 1998

[54] SOCKETS FOR ELECTRONIC COMPONENTS AND METHODS OF CONNECTING TO ELECTRONIC COMPONENTS

A 61-211977 9/1986 Japan .  
A 63-187653 8/1988 Japan .  
A 1-289147 11/1989 Japan .  
A 5-175376 7/1993 Japan .

## OTHER PUBLICATIONS

[75] Inventors: Thomas H. Dozier, II, Carrolton, Tex.; Benjamin N. Eldridge, Danville, N.Y.; Gary W. Grube, Pleasanton, Calif.; Igor Y. Khandros, Orinda, Calif.; Gaetan L. Mathieu, Dublin, Calif.

Bimetal VLSI Chip Interconnections, IBM Technical Disclosure Bulletin, vol. 29, No. 11, Apr. 1987.  
Interposer For Direct Chip Attach or Surface Mount Array Devices, IBM Technical Disclosure Bulletin, vol. 36, No. 7, Jul. 1993.

[73] Assignee: Form Factor, Inc., Livermore, Calif.

Cooling System For Semiconductor Modules, IBM Technical Disclosure Bulletin, vol. 26, No. 3B, 1993.

[21] Appl. No.: 533,584

[22] Filed: Oct. 18, 1995

Primary Examiner—Gary F. Paumen

Attorney, Agent, or Firm—David J. Larwood; Gerald E. Linden

## Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 526,246, Sep. 21, 1995, and Ser. No. 452,255, May 26, 1995, which is a continuation-in-part of Ser. No. 340,144, Nov. 15, 1994, and a continuation-in-part of PCT/US94/13373 published as WO95/14314 and Ser. No. 152,812, Nov. 16, 1993, Pat. No. 5,476,211, said Ser. No. 340,144, is a continuation-in-part of Ser. No. 152,812.

[51] Int. Cl.<sup>6</sup> ..... H01R 9/09

[52] U.S. Cl. .... 439/70; 439/66

[58] Field of Search ..... 439/70-73, 66,  
439/74, 68

## References Cited

## U.S. PATENT DOCUMENTS

5,098,305 3/1992 Krjewski et al. .... 439/75  
5,127,837 7/1992 Shah et al. .... 439/71  
5,386,341 1/1995 Olson et al. .... 439/66  
5,475,317 12/1995 Smith ..... 439/71  
5,531,022 7/1996 Beaman et al. .... 439/66  
5,611,696 3/1997 Donner et al. .... 439/71

## FOREIGN PATENT DOCUMENTS

0145 327 6/1985 European Pat. Off. .... H05K 7/02  
2643 753 2/1989 France ..... H01R 4/50  
2 680 284 2/1993 France ..... H01R 4/58  
A 60-49656 3/1985 Japan .

## [57] ABSTRACT

Surface-mount, solder-down sockets permit electronic components such as semiconductor packages to be releasably mounted to a circuit board. Resilient contact structures extend from a top surface of a support substrate, and solder-ball (or other suitable) contact structures are disposed on a bottom surface of the support substrate. Composite interconnection elements are used as the resilient contact structures disposed atop the support substrate. In any suitable manner, selected ones of the resilient contact structures atop the support substrate are connected, via the support substrate, to corresponding ones of the contact structures on the bottom surface of the support substrate. In an embodiment intended to receive a LGA-type semiconductor package, pressure contact is made between the resilient contact structures and external connection points of the semiconductor package with a contact force which is generally normal to the top surface of the support substrate. In an embodiment intended to receive a BGA-type semiconductor package, pressure contact is made between the resilient contact structures and external connection points of the semiconductor package with a contact force which is generally parallel to the top surface of the support substrate.

92 Claims, 9 Drawing Sheets

